IE 1071–Statistical Testing and Regression

Spring 2022

Instructor:	Shan Gong	**Time:**	Section 1 Mondays 8:15am - 11:00am
Email:	shan.gong@scupi.cn		Section 2 Mondays 13:50pm - 16:25pm
Office:	Room 4-221 (SCUPI)	**Place:**	Room 4-216 (SCUPI)

Note: This syllabus is subject to change. Please follow updates announced during class and posted on Blackboard website.

Course Web:

- https://pibb.scu.edu.cn/

- We will post lecture notes, assignments, projects, announcements and your grades on it.

Office Hours:

- Tuesdays & Fridays: 1:30 PM – 4:00 PM

- Send an email (shan.gong@scupi.cn) for quick discussions on questions, or to schedule an appointment

- Online via QQ Group: 283704186

Teaching Assistant:

- Section 1: Helen Wu; 2019141520146@stu.scu.edu.cn

- Section 2: Kiko Ye; 2019141520194@stu.scu.edu.cn

- If you have any question regarding to homework grading, please contact TA **within one week after the homework is returned to you**.

When emailing the instructor or TAs, include "IE 1071" in the subject field of your message. Use your university email account (student_ID_number@stu.scu.edu.cn), since mails from other accounts might be stopped by the SCU spam filter.

Course Description

The topics discussed are of great importance to any student majoring in engineering. Topics include hypothesis testing, analysis of variance (ANOVA), linear regression, categorical data analysis (e.g, contingency tables, loglinear models, logistic regressions and goodness of fit), and nonparametric statistics. 3 Credit Hours.

Prerequisites:

- IE 1070 Probability and Statistics for Engineers 1

Course Objectives

The main objective of this course is to provide a solid practical grounding in statistical tests and data analysis as well as other fundamental statistical methods that one will encounter in industrial engineering. Students should also be able to solve statistical problems employing R programming.

Applicable ABET Outcomes

1. An ability to apply knowledge of mathematics, science and engineering

2. An ability to analyze and interpret data

3. An ability to identify, formulate and solve engineering problems

4. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Textbook & References

- **Textbook:** Walpole, Myers, Myers and Ye (9th Edition), *Probability and Statistics for Engineers and Scientists*

- **Additional Reading: R** programming Manuals can be found at `https://cran.r-project.org/doc/manuals/`. You may find R-intro.pdf and R-data.pdf useful.

Software

We will use **R programming** for this course. **R** is an open-source software and its most up-to-date version can be downloaded from `https://cran.r-project.org/bin/windows/base/` for Windows, and `https://cran.r-project.org/bin/macosx/` for Mac OS. Afterwards, please also download and install RStudio Desktop, which is a powerful and free interface of **R**, from `https://rstudio.com/products/rstudio/download/`.

Grading

The grade will count the assessments using the following proportions:

Scheme: Total grade = 30% Assignments + 30% Midterm Exam + 30% Final Exam + 10% Projects.

Conversion of Numerical Grades to Final Letter Grades Follows the SCUPI Common Grade:

$90.00 - 100.00$	A	$85.00 - 89.99$	A-	$80.00 - 84.99$	B+	$76.00 - 79.99$	B	$73.00 - 75.99$	B-
$70.00 - 72.99$	C+	$66.00 - 69.99$	C	$63.00 - 65.99$	C-	$60.00 - 62.99$	D	$0.00 - 59.99$	F

Class Policy

Regular attendance is essential and expected in all lectures. Important dates and plans will be announced during class. **It is imperative that you come to class prepared.** This will generally involve reading one or more chapters of the textbook, viewing tutorial videos, thinking, engaging with fellow students, practice and performing preliminary calculations. This is a three credit hour class, which means you should expect to devote at least 9 to 12 hours of effort outside the scheduled class time every week.

Homeworks

Homework problems and other assignments will be assigned periodically and are due as stated in the assigned paper. All work will be submitted electronically through the Blackboard system. Late submission **WILL NOT** be accepted. It is **your duty** to make sure that submission through Blackboard has been properly processed. **Unless specifically requested, emailed homework will not be accepted.**

All of the homework scores will be used in your grade computation. Unless otherwise indicated, you can work with your fellow classmates in the class, but you must submit a distinct and independent write-up to receive credit. **If plagiarism is caught, zero score for all homeworks.** If you have a compelling emergency that prevents you from turning in the homework on time, email Dr. Shan Gong (shan.gong@scupi.cn).

If you believe an error has been made in the grading of an assignment, bring it to the attention of your TA **within ONE WEEK** from its return. Please adhere to these **homework guidelines:**

- Put your name, ID number (last four digits), and class section at the top of the first page.

- All work must be shown for each solution to receive full credit. Present your solution in a logical fashion, showing and explaining all steps in detail.

- Obtaining the correct answer includes getting the correct quantity, **number of significant digits**, sign, and **unit**.

Exams

There will be two exams (one Midterm and one Final), all are **CLOSED-BOOK**. Students can bring **one** A4 page note and it must be **hand-written** on **two sides** of the paper. It cannot be a photocopy. All midterm and final exams are mandatory. If you must miss an exam, you **MUST** make alternative arrangements with the instructor before the exam is given. If you missed an exam without prior notification, you will receive a score of **ZERO** for that exam except under extenuating circumstances. If you missed the midterm or final, a make-up exam may be given if the student has the approval from the instructor or emergencies and health issues **with a valid proof**. I will not accept the student deceleration for absence form for the final exam. Students who have not taken either the midterm or the final exams are **NOT** eligible to take th make-up exam if he/she failed the course. Students taking make-up exams can only attain at most a **D** grade if he/she failed the course.

Project

Students will work in small groups of $4 - 5$ students on each project. It is the responsibility of the groups to manage their own interactions and individual participation. Starting in Week 04 (tentatively), each group will be asked to consult TA for your project. The groups will make a professional-level presentation for project during Weeks 15 and 16 (tentatively). Each student in a group will receive the same grade based on the assessment of the project written report and presentation.

Academic Integrity

At Sichuan University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do.

Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called **plagiarism** and is a serious offense, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.

Paraphrasing, when the original statement is still identifiable and has also no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together Unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

Everyone at SCUPI is expected to treat others with dignity and respect. The Code of Student Conduct allows Sichuan University to take disciplinary action if students don't follow this community expectation.

Tentative Topics & Schedule

The schedule is tentative and subject to change. The listed objects below should be viewed as the key concepts you should grasp after each week, and also as a study guide before each exam, and at the end of the semester.

- **Week 1, Feb. 21 – Feb. 27**

    - Review Chapter 8, Overview and Introduction of R programming.
    - Random sampling, Sampling distributions of the mean and the sample variance.
    - Quantile and probability plots.

- **Week 2, Feb. 28 – Mar. 6** & **Week 3, Mar. 7 – Mar. 13**

    - Review Sections 9.1-9.9
    - One- and two-sample problems: point estimation and interval estimation.
    - Estimating the mean: single sample and two samples, confidence intervals, prediction intervals and tolerance intervals.

- **Week 4, Mar. 14 – Mar. 20**

    - Review Sections 9.10-9.15
    - Estimating a proportion: single sample and two samples.
    - Estimating the variance: single sample and two samples.

- **Week 5, Mar. 21 – Mar. 27**

    - Sections 10.1-10.7
    - Hypothesis tests for means. P-values in testing hypothesis.

- **Week 6, Mar. 28 – Apr. 3**

    - Sections 10.8-10.15
    - Hypothesis tests for proportions.
    - Categorical data analysis: the χ^2 goodness of fit test, the χ^2 test for independence and homogeneity.

- **Week 7, Apr. 4 – Apr. 10**

    – Sections 11.1-11.9

    – Linear regression analysis.

- **Week 8, Apr. 11 – Apr. 17**

    – Sections 11.10-11.13 & 12.1-12.5

    – Transformations, correlation and multiple linear regression.

- **Week 9, Apr. 18 – Apr. 24**

    – Sections 12.6-12.12

    – Multiple linear regression analysis and certain nonlinear regression models.

- **Week 10, Apr. 25 – May. 1**

    – Section 12.13.

    – Summary of multiple linear regression

- **Week 11, May. 2 – May. 8**

    – Sections 13.1-13.6

    – One-way ANOVA

- **Week 12, May. 9 – May. 15**

    – Sections 13.6-13.13

    – Blocking and graphical methods

- **Week 13, May. 16 – May. 22**

    – Chapter 14

    – Factorial experiments (two or more factors)

- **Week 14, May. 23 – May. 29**

    – Chapter 16

    – Nonparametric statistics

- **Week 15, May. 30 – Jun. 5**

    – Project presentations

- **Week 16, Jun. 6 – Jun. 12**

    – Project presentations

    – Review session

- **Week 17, Jun. 13 – Jun. 19**

    – Final Exam